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**(54) TREATMENT METHOD FOR MAKING PRODUCT EQUIPPED WITH LCD HARMLESS AND FOR USING THE PRODUCT AS RESOURCE**

(57)Abstract;

**PROBLEM TO BE SOLVED:** To provide a method for making a product equipped with a LCD(liquid crystal display) harmless and for using the product as a resource with hardly forming gas and without manual aid.

**SOLUTION:** This method for making a product equipped with a LCD harmless and for using the product as a resource comprises a process for introducing the product equipped with the LCD in the original form without crushing into a furnace and pyrolyzing, gasifying and melting the product equipped with the LCD under oxygen-free condition, a process for making the gas generated in the furnace harmless by combusting the gas at a temperature at which harmful substances other than dioxins are decomposed without forming dioxins, a process for separating products pyrolyzed, gasified and melted using a sieve into glass, metal, electronic parts and tar, a

process for pulverizing the glass separated and a process for treating the pulverized glass with a reagent to separate and remove the residue stuck on the glass. The obtained glass and metal are reused, and gold and other metals are taken out of the electronic parts, and further the tar is used as fuel. In this method, since it is not needed to disassemble and crush waster products, manpower can be saved markedly.

## **DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which an invention belongs] this invention relates to detoxication / recycling disposal method of LCD equipment products which the reduction rate of the ultimate disposal thing was markedly alike, and was excellent while being able to recycle waste especially about the discarding treatment of various equipment provided with LCD (liquid crystal display), such as a notebook sized personal computer and a cellular phone.

[0002]

[Description of the Prior Art] The electronic equipment which uses LCD, such as a notebook sized personal computer, TV game, and a portable telephone, spread quickly, and it is generated by a lot of waste. Progress of these apparatus is rapid, and also where a life is left, it lays on the shelf of it in many cases. Although there is also a secondhand market, since progress of apparatus is rapid, a used article has many which are turned to abandonment rather than the reuse of the obsoleting is carried out further early, and the quantity of waste is huge. Then, it gropes for the safe abandonment method of a lot of electronic equipment.

[0003] Under such a situation, a household appliance approach is due to enforce in 2001, and each maker company is competing fiercely to the correspondence. As an object of a household appliance approach, processing of LCD poses a problem especially.

[0004] Drawing 3 shows the structure of typical LCD of the amorphous silicon TFT currently most used in a personal computer. First, there is the upper part glass substrate 1 in the upper part, the polarizing plate 2 made of a synthetic resin is stuck on the upper surface, and the light filter 3 of R, G, B, and a black matrix is formed in the undersurface. There is the bottom glass substrate 5 in which the TFT array circuits 4, such as an insulation protection film, a semiconductor layer, and various conducting films (electrode), were formed in the lower part. And the liquid crystal material 6 is sandwiched with the orienting films 7 and 7 and the counterelectrode 8 in the middle of the glass substrate of these upper and lower sides. The sealant 9 is around the liquid crystal material 6. It lets the whole seal pass, and has structure which light can pass to a sliding direction, selection of a color is made with a light filter, and the shade of a pixel is chosen by the state of a liquid crystal layer. The state of a liquid crystal layer is electrically controlled by a TFT array.

[0005] In glass, the polarizing plate of the component of such LCD is just over or below 15% just over or below 85% in a wt. ratio. Liquid crystal materials other than this, seals resin, a color filter layer, a TFT layer, etc. have few thousands of ppm and ratios. However, in these minute things, rare metals, such as indium currently used for the transparent electrode, are also contained.

The value as resources is high.

About a chemical agent, a paint, and TFT, heavy metals are contained, and when it discards as it is, it becomes a problem.

[0006] By the way, the discarding treatment methods of LCD performed conventionally included the following methods.

1 A general-waste-management-service company grinds LCD equipment products, such as a personal computer, in pieces, reclaims land from them, and processes them.

2 Divide a personal computer roughly into a base, a keyboard, and a display, and

recyclables recycle a plastic, the precious metals, etc., and grind other portions, especially a display portion, etc. in pieces like the above 1, and they carry out reclamation processing.

3 This is the two above-mentioned improved methods. Although the base, the keyboard, etc. are the same, Separation Sub-Division of the display portion is carried out. Divide the separated display portion into a liquid crystal module part and a case further, and a case is made to recycle as a plastic, it reclaims land from a liquid crystal module part after grinding as scrap glass, and it is processed.

[0007]Although the above is an example of representation of the processing performed now, all are the disposal methods currently regarded as questionable from the standpoint of environmental protection. That is, there was no effective disposal method about a liquid crystal display. Although it is a subject for the above-mentioned disposal method to reclaim land and to process, reservation of the reclamation lot is increasingly more difficult.

Even when carrying out reclamation, to make capacity small and to reclaim land from it as much as possible, is desired.

[0008]On the other hand, the applicant has proposed detoxication recycling and the harmless discarding treatment method of a flat-panel display in Tokuganhei11-89416. The liquid crystal material with which this was laminated between two glass substrates of a liquid crystal display, and these, The liquid crystal component gas emitted when the flat-panel display for electronic equipment which consists of a polarizing plate, a thin film semiconductor, etc. is crushed and crushed, or organic mist is made to stick to activated carbon etc., or a pyrolysis and gasification fusion are carried out according to an elevated temperature, and it detoxicates.

[0009]According to this method, it becomes possible to detoxicate and recycle most troublesome LCD from the waste of the apparatus which uses LCD.

[0010]

[Problem(s) to be Solved by the Invention]However, in the above-mentioned disposal method, from the apparatus by which it was equipped with LCD, it had to decompose manually etc., the LCD portion had to be removed and ground, and many helps had started. This invention was considered from such a fact and an object of this invention is to provide detoxication / recycling disposal method of the LCD equipment products which do not require a help.

[0011]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, detoxication / recycling disposal method of LCD equipment products of this invention is provided with the following.

A pyrolysis and a gasification fusion process which a synthetic resin heats to temperature of a range which a pyrolysis, various metal which carries out gasification fusion and is contained in a product, and glass do not fuse in the state where LCD equipment products are put into a furnace with a product, without grinding and decomposing, and there is no oxygen

A process of carrying out detoxicating treatment of the gas emitted in a furnace.

A process which sifts out a pyrolysis and a product by which gasification fusion was carried out, and is divided into glass, metal, electronic parts, and tar, a process of grinding

separated glass, and a process of carrying out separation removal of the remnants which carried out the chemical treatment of the ground glass, and have adhered.

[0012]Have composition which makes it a vacua whether to be filled up with inactive gas in the above-mentioned furnace, and is changed into a thin state of anoxia or oxygen, or, It can have composition which a process of carrying out detoxicating treatment of the gas emitted in the above-mentioned furnace is the temperature which dioxin does not generate, and is a process burned at an elevated temperature into which other toxic substances are disassembled.

[0013]A process of grinding glass separated [ above-mentioned ], and a process of carrying out separation removal of the remnants which carried out the chemical treatment of the ground glass, and have adhered, It is good also as composition which established a process of separating and collecting remnants which sifted out glass ground between \*\* and have adhered, and established a process of collecting indium from remnants obtained by sieving, and remnants in which separation removal was carried out by the above-mentioned chemical treatment.

[0014]

[Function]Without decomposing or grinding LCD equipment products, it makes into a vacua whether to be filled up with inactive gas as it is, and it supplies to the furnace which changed into the thin state of anoxia or oxygen, and heats. Portions, such as a synthetic resin, are carbonized without burning, since LCD products do not have oxygen. Although neither glass nor metal is fused, it will be in a state like charcoal where the carbonized synthetic resin stuck.

[0015]If such a carbonized product is hung on the vibrating screen of a barrel machine and vibration is given, the portion of the carbonized tar can separate and fall and a metal piece, electronic parts, a glass piece, and tar can be separated from charcoal-like products. Electronic parts have pointed out the IC circuit, CPU of the computer, etc.

[0016]A metal piece is classified and reused for every metal. Since golden content is high, especially electronic parts are turned to recovery of gold and the other metal. Tar can be used as fuel.

[0017]Glass is reused, after being ground, separating into glass and remnants, such as tar, being further processed from acid etc. and removing an impurity. Indium of a rare metal is collected from the liquid by which acid treatment was carried out to the remnants adhering to glass.

[0018]

[Embodiment of the Invention]Drawings explain working example of this invention below. Drawing 1 is a flow chart explaining detoxication / recycling disposal method of the LCD equipment products of this invention. The method of this invention shown in the figure makes the main processes a pyrolysis and the gasification fusion down stream processing 10, the gas detoxicating treatment process 20, the partition process 30, and the glass detoxicating treatment process 40. Hereafter, each process is explained in detail.

[0019][A pyrolysis and gasification fusion down stream processing] Here, the discarded LCD equipment products are fed into a furnace in the state as it is in decomposition or grinding, without being carried out at all. The inside of a furnace is made into the state filled up only with inactive gas, such as nitrogen gas and argon gas, or a vacua, and is maintained at an anoxia state or the state where oxygen was rarefied as much as possible.

A furnace will be heated, if waste is thrown in and the inside of a furnace will be in the above-mentioned anoxia state. Various kinds of synthetic resins used for LCD equipment products as cooking temperature. It is below the temperature which the metal which a liquid crystal material, a polarizing plate, adhesives, a light filter, etc. which are used for LCD exceed the temperature which carries out a pyrolysis and gasification fusion, and is contained in LCD equipment products, such as glass, an aluminum containing alloy, copper, and gold, does not fuse. Specifically, about 873-923K are suitable.

[0020]Since a synthetic resin becomes a pyrolysis and tar like [ if gasification fusion is carried out ] charcoal which carbonizes, it is necessary to make it higher than a pyrolysis and gasification fusion temperature. On the other hand, if the temperature which glass and metal fuse is reached, glass and metal will fuse in a furnace, and it will be in a liquid state, and will become one with the carbonized plastic, and dissociating afterwards will become difficult. Therefore, it is necessary to make it below the temperature that neither glass nor metal fuses.

[0021]In this way, after a pyrolysis and gasification fusion down stream processing are completed, the tar (solid content) from which the portion of plastics changed, electronic circuits, such as IC, metal pieces, such as a metal substrate, and the glass piece currently used for the liquid crystal panel remain as remnants of LCD products. These are so weak that it collapses scatteringly, if little power can be applied.

[0022][Gas detoxicating treatment process] In the above-mentioned pyrolysis and gasification fusion down stream processing, the gas in which resin, a liquid crystal material, adhesives, a paint, etc. are various when carrying out gasification fusion, a pyrolysis and is emitted. A substance, chlorobenzene, chlorophenol, etc. which make poisonous dioxin generate are contained in these gases. If these gases are burned at low temperature, dioxin will occur.

[0023]So, in this invention, generating gas is burned under about 1573K elevated temperature at this process. If such an elevated temperature is used, dioxin will not be generated, but chlorobenzene and chlorophenol will be disassembled and the exhaust gas after combustion will also be detoxicated. In this invention, since it heats in the state of anoxia unlike the former, the yield of gas decreases and processing becomes easy.

[0024]As gas detoxicating treatment, an option is also possible. After taking out the gas emitted within the furnace which is carrying out a pyrolysis and gasification fusion processing and making it cool by a suitable method, it is the method of making it sticking to activated carbon.

[0025][Partition process] Although it changes a LCD use device into a roast state by a pyrolysis and gasification fusion down stream processing and becomes a thing of the shape of remnants which tar, electronic circuits, such as IC, the metal piece, and the glass piece mixed, these remnants are hung on the vibrating screen of a barrel machine. Here, since much remnants are put on a sieve and can add vibration, the tar which remnants collided and has adhered separates scatteringly, and falls, and a opening of sieve is passed.

[0026]In the place of a sieve, although remnants are divided tar and in addition to it, they can be easily divided into metal, electronic parts, and glass by viewing. And metal is divided into classification and reused. Tar can be used as fuel. Since electronic parts contain gold other than metal, such as copper, they are turned to the publicly known processing which extracts these metal.

[0027]Although it is finally glass, tar has still adhered to this and, the way things stand, it cannot recycle. ITO, i.e., indium of a rare metal, is contained in this glass. Then, detoxicating treatment is carried out with the flow chart shown in drawing 2. This is details of degree [ glass harmless chemically-modified ] 40 of drawing 1, and consists of the grinding process 41, the separation process 42, the sieving processes 43 and 44, and the chemical treatment process 45.

[0028][Grinding process] A glass crusher etc. grind the glass separated from remnants. Since heavy metals, such as an adhering light filter, tar of an insulation protection film, a semiconductor layer, various conducting films, such as tar of sensitized materials, such as R, G, and B, and chromium, have adhered to this glass, some of those remnants exfoliate by the above-mentioned grinding, and it dissociates.

[0029][Separation process] Reuse purpose-oriented sorts out the ground glass to a high-grade approach and a low-grade approach.

[0030][Sieving 1] This is a low-grade approach. Glass is sifted out and it divides into glass and remnants. Although remarkable chromium, a semiconductor layer, a conducting film, etc. have adhered to glass, it is processed into brick or a tile as it is. A remnants portion turns to indium recovery. However, it seems that it changes to the decreasing tendency from now on since the toxic substance has been included although this method is some.

[0031][Sieving 2] Here, high-grade processing is carried out. Glass is sifted out and it divides into glass and remnants. Glass progresses to the following chemical treatment process further. Remnants go to indium recovery.

[0032][Chemical treatment] Here, ITO etc. which are contained in chromium adhering to glass or a conducting film are washed and dropped on acid. As acid, what can melt the metal contained in remnants, such as chromium and indium, is used, for example, fluoric acid, chloride, etc. are used. It becomes glass which glass has all remnants dropped on this process, and does not have an impurity. And it will be neutralized and washed in cold water, will become a glass cullet and will be used as re-resources. The solution of the remnants obtained by pickling is turned to recovery of indium with the above-mentioned remnants.

[0033]According to above-mentioned working example, it becomes possible to heat LCD equipment products at an elevated temperature, and to reuse as resources a pyrolysis and most remnants which carried out gasification fusion and remained after that, therefore, there are dramatically few ultimate disposal things, and a reduction rate boils them markedly and improves. Therefore, it becomes possible to make the problem of reservation of new reclaimed ground into the minimum.

[0034]

[Effect of the Invention]As explained above, detoxication / recycling disposal method of the LCD equipment products of this invention, The pyrolysis and gasification fusion process which a synthetic resin heats to the temperature of the range which a pyrolysis, the various metal which carries out gasification fusion and is contained in a product, and glass do not fuse in the state where LCD equipment products are put into a furnace and there is no oxygen, The process of carrying out detoxicating treatment of the gas emitted in the furnace, and the process which sifts out a pyrolysis and the product by which gasification fusion was carried out, and is divided into glass, metal, electronic parts, and tar, Since it is the composition of having the process of grinding the separated glass, and

the process of carrying out separation removal of the remnants which carried out the chemical treatment of the ground glass, and have adhered and any synthetic resins other than metal and glass do not burn like before, generating of poisonous gas can be lessened. [0035]Since a pyrolysis and gasification fusion processing are carried out without grinding and decomposing with a product, the time and effort etc. which remove the portion of LCD from a product become unnecessary. Since a pyrolysis and a gasification fusion process are performed in the state without oxygen, tar can be taken out from plastics and this can be used as fuel.

[0036]It makes into a vacua whether to be filled up with inactive gas in the above-mentioned furnace, and without burning LCD equipment products, if it has composition changed into the thin state of anoxia or oxygen, it is stabilized and a pyrolysis and gasification fusion can be performed.

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## CLAIMS

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[Claim(s)]

[Claim 1]In the state where LCD equipment products are put into a furnace with a product, without carrying out grinding and decomposition, and there is no oxygen. A pyrolysis and a gasification fusion process which a synthetic resin heats to temperature of a range which a pyrolysis, various metal which carries out gasification fusion and is contained in a product, and glass do not fuse. A process of carrying out detoxicating treatment of the gas emitted in a furnace, and a process which sifts out a pyrolysis and a product by which gasification fusion was carried out, and is divided into glass, metal, electronic parts, and tar, Detoxication / recycling disposal method of LCD equipment products having a process of grinding separated glass, and the process of carrying out separation removal of the remnants which carried out the chemical treatment of the ground glass, and have adhered.

[Claim 2]Detoxication / recycling disposal method of the LCD equipment products according to claim 1 making into a vacua whether to be filled up with inactive gas in the above-mentioned furnace, and changing into a thin state of anoxia or oxygen.

[Claim 3]Detoxication / recycling disposal method of the LCD equipment products according to claim 1 or 2 a process of carrying out detoxicating treatment of the gas emitted in the above-mentioned furnace being the temperature which dioxin does not generate, and being the processes which burn gas at an elevated temperature into which other toxic substances are disassembled.

[Claim 4]A process of grinding glass separated [ above-mentioned ], and a process of carrying out separation removal of the remnants which carried out the chemical treatment of the ground glass, and have adhered, Remnants which established a process of separating and collecting remnants which sifted out glass ground between \*\* and have adhered, and were obtained by sieving, Detoxication / recycling disposal method of the LCD equipment products according to any one of claims 1 to 3 establishing a process of collecting indium from remnants in which separation removal was carried out by the above-mentioned chemical treatment.